

ELECTRONICS TECHNOLOGY



PURPOSE

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of electronics technology.

First, refer to General Regulations, Page 9.

CLOTHING REQUIREMENT

For men: Official SkillsUSA white polo shirt with black dress slacks, black socks and black leather shoes.

For women: Official SkillsUSA white polo shirt with black dress slacks or skirt, black socks or black or skin-tone seamless hose, and black leather shoes. All: Safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase the polo shirt, contact Midwest Trophy Manufacturing Co. Inc. by calling 800-324-5996 or order online at www.mtmrecognition.com/skillsusa/.

Note: Contestants must wear their official contest clothing to the contest orientation meeting.

ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with industrial electronics or electronics technology as the occupational objective.

EQUIPMENT AND MATERIALS

1. Supplied by the technical committee:
 - a. All materials, supplies and job information needed to construct and test the designed circuit
2. Supplied by the contestant:
 - a. Small pliers
 - b. Wire cutter
 - c. Wire stripper for No. 28 and No. 30 gauge wire
 - d. Small assorted screwdriver set (Phillips and slotted)
 - e. 25-watt soldering iron and associated soldering supplies (Note: No soldering guns allowed)

- g. Other hand tools as desired, subject to the approval of the technical committee
- h. Portable VM/VOM Multimeter*
- i. 20 or more MHz dual trace oscilloscope*
- j. Three 10x probes
- k. Calculators (can have scientific notation, but cannot be programmable)

*May be supplied by technical committee. Check SkillsUSA Championships updates annually at skillsusa.org/compete/updates.shtml.

SCOPE OF THE CONTEST

The contest will assess the ability to apply theoretical and practical knowledge of "state of the art" electronic industry standards as determined by the International Society of Certified Electronics Technicians. Additionally, the contest also requires contestant proficiency of competencies listed by the National Coalition for Electronics Education — Basic Electronics. Contestants will demonstrate their ability to perform jobs or skills from the following list of competencies as determined by the SkillsUSA Championships technical committee, which includes: Electronics Supply Co. Inc., NIDA Corp. and United States Postal Service.

Knowledge Performance

The contest includes a written knowledge test. The exam is an industry-standard written test, currently the JSCEIT apprentice level examination. This may change as needs or standards are updated. If there is a need to change or revise the exam, the change will be posted on the SkillsUSA Web site.

Skill Performance

The contest will include a breadboard project that will require competitors to read and follow instructions, interpret a circuit design drawing, identify and correct design flaws, and construct a variable-power DC power supply and a random number generator.

Contest Guidelines

1. Contestants will be provided with the characteristics, parameters and information to accomplish the assigned tasks.
2. Time limit:
 - a. Contestants will begin upon a signal from the time keeper.
 - b. As soon as contestants have completed the assignment and are fully satisfied with the operation and quality of their work, they will signal the judge and stop

- their work. This signal will determine elapsed time and speed.
3. The completed projects will be tested by the judges for quality of work and operating specifications.

Standards and Competencies

ET 1.0 — Interpret, record, and report technical data from provided materials to related ISCET standards

- 1.1 Draw and interpret electronic schematics
- 1.2 Record data and design curves and graphs
- 1.3 Write reports
- 1.4 Maintain test logs
- 1.5 Make equipment failure reports
- 1.6 Specify and requisition simple electronic components
- 1.7 Compose technical letters
- 1.8 Write formal reports of laboratory experiences

ET 2.0 — Apply knowledge of DC circuits to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET

- 2.1 Solve basic algebraic problems as applicable to electronics
- 2.2 Relate electricity to nature of matter
- 2.3 Identify sources of electricity
- 2.4 Define voltage, current, resistance, power and energy
- 2.5 Apply and relate Ohms Law
- 2.6 Read and interpret color codes to identify resistors
- 2.7 Measure properties of a circuit using VOM and DVM meters
- 2.8 Compute and measure conductance and resistance of conductors and insulators
- 2.9 Analyze, construct and troubleshoot series circuits, parallel circuits, series-parallel circuits and voltage dividers
- 2.10 Solve network theorem problems using Kirchhoff, Thevenin, Norton, Superposition and Delta-Wye
- 2.11 Analyze, construct and troubleshoot maximum power transfer theory
- 2.12 Define magnetic properties of circuits and devices
- 2.13 Determine physical and electrical characteristics of capacitors and inductors
- 2.14 Analyze and measure RL and RC time constants
- 2.15 Set up and operate a VOM, DVM, power supplies and oscilloscopes for DC circuits

ET 3.0 — Apply knowledge of AC circuits to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET

- 3.1 Solve basic trigonometric problems as applicable to electronics (prerequisite to AC)
- 3.2 Identify properties of an AC signal
- 3.3 Identify AC sources
- 3.4 Analyze and measure AC signals using oscilloscope, frequency meters and generators
- 3.5 Analyze, construct and troubleshoot AC capacitive circuits, AC inductive circuits, RLC circuits (Series, Parallel, Complex) series and parallel resonant circuits, filter circuits and polyphase circuits
- 3.6 Analyze basic motor theory and operation
- 3.7 Analyze basic generator theory and operation
- 3.8 Set up and operate VOM, DVM and power supplies for AC circuits
- 3.9 Set up and operate oscilloscopes, frequency counters, signal generators, capacitor-inductor analyzers and impedance bridges for AC circuits
- 3.10 Analyze and apply principles of transformers to AC circuits

ET 4.0 — Apply knowledge of solid-state devices to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET

- 4.1 Identify properties of semiconductor materials
- 4.2 Analyze and measure characteristics of P-N junction diodes
- 4.3 Analyze and measure characteristics of special diodes
- 4.4 Analyze, construct and troubleshoot diode circuits
- 4.5 Identify, define and measure characteristics of bipolar transistors, thyristors and integrated circuits
- 4.6 Set up and operate VOM, DVM and power supplies for solid state devices
- 4.7 Set up and operate oscilloscopes, frequency counters, signal generators, capacitor-inductor analyzers and impedance bridges for solid state devices
- 4.8 Set up and operate curve tracers and transistor testers

ET 5.0 — Apply knowledge of analog circuits to a given scenario using related competencies of NCEE-Basic Electronics and ISCET-CET

- 5.1 Analyze, construct and troubleshoot single-stage amplifiers, multi-stage amplifiers, basic power supplies and filters, power

- supply regulators, active filters, and oscillators
- 5.2 Analyze motor or phase control circuits
- 5.3 Set up and operate VOM, DVM and power supplies for analog circuits
- 5.4 Set up and operate oscilloscopes, frequency counters, signal generators, and capacitor-inductor analyzers for analog circuits
- 5.5 Set up and operate impedance bridges for analog circuits
- 5.6 Set up and operate recorders for analog circuits

ET 6.0 — Apply knowledge of digital devices to a given scenario using related competencies of NCEE-Basic Electronics and IS CET-CET

- 6.1 Define and apply number systems to codes and arithmetic
- 6.2 Analyze, construct and troubleshoot logic gates, logic arithmetic circuits, flip-flops, and encoders and decoders
- 6.3 Identify, define and measure characteristics of IC logic families
- 6.4 Analyze, construct and troubleshoot registers and counters, clock and timing circuits, multiplexers and demultiplexers, digital to analog, and analog to digital
- 6.5 Analyze, construct and troubleshoot displays and representative digital systems
- 6.6 Set up and operate VOM, DVM and logic probes for digital devices
- 6.7 Set up and operate power supplies, pulsers, oscilloscopes, logic analyzers, signature analyzers, pulse generators, and counters for digital devices

ET 7.0 — Apply knowledge of microprocessors to a given scenario using related competencies of NCEE-Basic Electronics and IS CET-CET

- 7.1 Analyze, construct and troubleshoot CPUs, BUS systems, memory systems and input/output ports, microprocessor applications and systems
- 7.2 Execute computer instruction sets
- 7.3 Analyze and troubleshoot microprocessor systems
- 7.4 Set up and operate VOM, DVM, power supplies, pulsers, oscilloscopes, logic/data analyzers, signature analyzers, pulse generators, and counters for microprocessing

ET 8.0 — Use laboratory practices common to industry situation

- 8.1 Demonstrate proper OSHA related safety standards
- 8.2 Make electrical connections

- 8.3 Identify and use hand and power tools used in electronics technology
- 8.4 Utilize standard troubleshooting procedures for defective circuits

Committee Identified Academic Skills

Math Skills

- Solve practical problems involving percents
- Solve single variable algebraic expressions
- Solve multiple variable algebraic expressions
- Make comparisons, predictions and inferences using graphs and charts

Science Skills

- Plan and conduct a scientific investigation
- Use knowledge of the particle theory of matter
- Describe characteristics of types of matter based on physical and chemical properties
- Use knowledge of physical properties (shape, density, solubility, odor, melting point, boiling point, color)
- Use knowledge of classification of elements as metals, metalloids and nonmetals
- Understand Law of Conservation of Matter and Energy
- Describe phases of matter
- Describe and identify physical changes to matter
- Use knowledge of potential and kinetic energy
- Use knowledge of mechanical, chemical, and electrical energy
- Use knowledge of heat, light and sound energy
- Use knowledge of temperature scales, heat and heat transfer
- Use knowledge of work, force, mechanical advantage, efficiency and power
- Use knowledge of simple machines, compound machines, powered vehicles, rockets and restraining devices
- Use knowledge of principles of electricity and magnetism
- Use knowledge of static electricity, current electricity and circuits
- Use knowledge of magnetic fields and electromagnets
- Use knowledge of motors and generators

Language Arts Skills

- Demonstrate comprehension of a variety of informational texts
- Use text structures to aid comprehension
- Demonstrate knowledge of appropriate reference materials

- Use print, electronic databases and online resources to access information in books and articles

Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic standards.

Math Standards

- Numbers and Operations
- Algebra
- Geometry
- Measurement
- Data Analysis and Probability
- Problem Solving
- Reasoning and Proof

Source: NCTM Principles and Standards for School Mathematics.

To view high school standards, visit:

standards.nctm.org/document/chapter7/index.htm.

Select "Standards" from menu.

Science Standards

- Understands the structure and properties of matter
- Understands the sources and properties of energy
- Understands forces and motion
- Understands the nature of scientific knowledge
- Understands the nature of scientific inquiry

Source: McREL compendium of national science standards. To view and search the compendium, visit: www.mcrel.org/standards-benchmarks/.

Language Arts Standards

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies and their understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics)

- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes
- Students apply knowledge of language structure, language conventions (e.g., spelling and punctuation), media techniques, figurative language and genre to create, critique and discuss print and nonprint texts
- Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information)

Source: IRA/NCTE Standards for the English Language Arts. To view the standards, visit:

www.readwritethink.org/standards/index.html.

CONTEST SCORECARD

Items Evaluated	Possible Points
Written Exam.....	150
Customer Service.....	200
Soldering.....	200
Bread Boarding.....	200
Troubleshooting.....	250

Sub Total	1,000
Résumé Penalty (5 percent)	_____
Clothing Penalty (Up to 5 percent)	_____
TOTAL	_____

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